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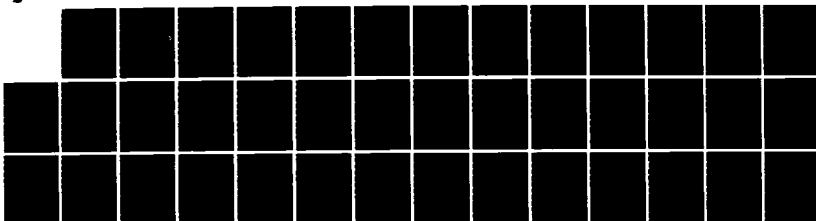
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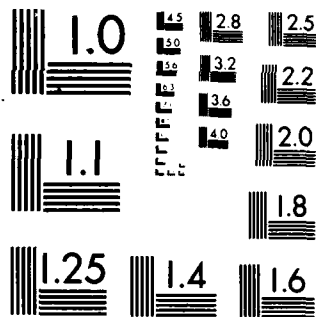
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The Operational
Center of Gravity

by

Major Thomas M. Kriwanek
Infantry

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School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

27 May 1986

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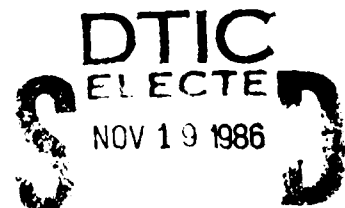
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ABSTRACT

THE OPERATIONAL CENTER OF GRAVITY: An analysis of the concept at the operational level, by Major Thomas M. Kriwanek, USA, 26 pages.

This study examines the concept of the operational center of gravity and whether it has relevance for operations today. The purpose of this analysis is to determine the definition of the operational center of gravity and how this concept can be used by the individual practicing operational art. The roots of the concept, as well as current explanations, are examined to determine the applicability of this concept. Two historical examples from World War II are illustrated to assist in clarifying the concept. Multiple centers of gravity are explored as well as their value to the operational artist.

One of the conclusions drawn from this investigation is that there is usually but one center of gravity at the operational level. This center of gravity is supported by several sub-centers of gravity that give the center its freedom of action. These sub-centers form the spokes of the wheel that support the hub, from which the force attains its freedom of action. These spokes are relative in nature and consist of the strengths and weaknesses of the force. Unbalancing these spokes, while protecting one's own, should be the object of the operational commander. This allows for the indirect approach which results in success on the modern battlefield.

THE OPERATIONAL CENTER OF GRAVITY

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THE OPERATIONAL CENTER OF GRAVITY

INTRODUCTION

The term 'center of gravity' is used rather freely by military commentators to indicate that they have read Carl von Clausewitz and possess a firm background in military theory. This particular concept appears to be little understood but often quoted -- probably second only to 'war is merely the continuation of policy by other means.' Consequently, the 'center of gravity' does not have the same meaning for all operational planners. There is confusion about exactly what the center of gravity means and whether it is a useful term for the planner. The assertion that must be analyzed, as posed by Clausewitz, is whether there is 'one hub of all power and movement, on which everything depends' during an operational campaign.

The purpose of this monograph is to determine if the operational center of gravity can be clearly defined and used to advantage by the individual practicing operational art.

The origin of the military term, 'center of gravity,' is Carl von Clausewitz's masterpiece, On War. His work has been elaborated by the authors of FM 100-5, Operations to become the basis of the U.S. Army's current operational doctrine. It is useful to look at what the term conveys in several different situations and how the military term is

sometimes confused with other similar, but not identical concepts.

Webster's New World Dictionary of the American Language defines the center of gravity as:

That point in a thing around which its weight is evenly distributed or balanced: center of mass: point of equilibrium. 1

This is not what the operational planner is looking for when developing his campaign plan. The term, as used by Webster, may have little relevance. Since Webster's definition is the one that is commonly understood, the term may provide more confusion than enlightenment.

The definition of the center of gravity from a basic flight manual may come closer to the desired meaning. There it is defined as the point in an airplane, regardless of attitude, about which the plane can be balanced perfectly. This point is the center of the airplane's total weight and all movement of the aircraft in flight revolves around this center of gravity.² The latter portion of the flight definition is particularly important as it further states that if the center of gravity is upset, the airplane will cease to fly. The center of gravity used in this context differs from Webster's definition and suggests an important dynamic aspect to the concept. As a result, the flight manual's explanation of the center of gravity is closer to what the military planner needs when formulating a campaign. This use of the term establishes that the center of gravity

depends upon several interdependent sub-systems of the aircraft to maintain a proper center of gravity, rather than the mere central location of the mass of the aircraft.

Carl von Clausewitz defined the center of gravity in Book Eight, Chapter Four of On War as follows:

"What the theorist has to say here is this: one must keep the dominant characteristics of both belligerents in mind. Out of these characteristics a certain center of gravity develops, the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed."³

While this definition appears to apply to the strategic, operational and tactical levels of operations, Clausewitz was clearly directing his thoughts to the strategic level of war. He hypothesized that the best way to begin to attack the center of gravity is the destruction of the enemy fighting force. Clausewitz went on to say that on occasion the seizure of the capital or an effective blow against a principal ally can also defeat the enemy.

Clausewitz identified the battle as the most effective way to attack the center of gravity. The major battle to destroy the enemy field force is regarded as the center of gravity of the entire conflict or campaign.⁴ Furthermore, he contended that the most effective target for a blow is always found where the mass is concentrated most densely.⁵ The major act of strategic judgment, thence operational judgment, is to determine the centers of gravity within the

enemy's forces and to identify their spheres of effectiveness.⁶ These ideas, as stated, negate the indirect approach.

In Book Six, Chapter Twenty-Seven On War, Clausewitz stated that a particular theater always affects directly adjoining areas. Thus, in a theater of operations, there is a unity that exists which allows for the identification of a single center of gravity.⁷ In those few cases where several centers of gravity can not be reduced to one, the commander has two wars.⁸ Thus, it appears that Clausewitz took a strategic view of the concept of the center of gravity. The identification of the center at the strategic level appears to be a relatively simple process but that does not mean that it is easy.⁹ This assumes that the center of mass of the field force is always the best route to victory. Whether Clausewitz's view of the center of gravity applies to the operational level of war remains to be analyzed. As Clausewitz states, definitions are aimed only at the centers of certain concepts; we neither wish nor can we give them precise outlines and the nature of these concepts should make this obvious enough.¹⁰ The operational center of gravity may well be one of these concepts.

Appendix C, of FM 100-5, Operations, (Oct 85), states that the concept of centers of gravity is the key to all operational design. The field manual further states that the center of gravity is the source of strength or balance

from which the force derives its freedom of action, physical strength, or will to fight. According to the appendix, the use of this concept is especially applicable at the operational level. On the other hand, the size and scope of operations at this level make it difficult to determine how best to attack the center of gravity. Thus, protecting one's own center of gravity while identifying and destroying the enemy's is the essence of the operational art.¹¹

Operational centers of gravity appear to conflict with Clausewitz's concept of one center of gravity. In a dynamic, changing campaign there may be several sub-centers of gravity, which, if successfully attacked, will cause the enemy's operational campaign to unravel. The enemy's reaction to an initiative may actually uncover his center of gravity in an operational campaign. In an operation, there may be several sub-centers of movement, much like the gears of a clock. If any one of these gears can be destroyed, the clock will cease to function.

The function of an automobile illustrates this concept. The center of gravity is the motor. While a very rugged motor can be present, the automobile is dependent upon several important sub-centers of gravity for proper function of the transportation mission. A hydraulic leak in the brake system will end the automobile's utility without a direct attack on the motor. A broken transmission or suspension system will achieve similar results. A pinhole

in the bottom of the gas tank will eventually stop the motor. All of the sub-centers of gravity contribute to the power of the center of movement, the motor.

The planner must determine what the key sub-centers of gravity are in any given operation. There will probably be more than one sub-center of gravity, or center of movement, that will lead to the successful outcome of the campaign. The objective, however, is to identify the sub-center of gravity that will lead to success at the lowest possible cost. The destruction of an enemy army group may be the desired result of a campaign. Toward this end, one might employ nuclear weapons on enemy concentrations to achieve the desired result. Complete air superiority may lead to total defeat in detail. The denial of resupply requirements could bring about the same success. These three options will all lead to the enemy's loss of freedom of action, physical strength, or will to fight. However, the cost effectiveness of each option is entirely another matter. The introduction of nuclear weapons may expose one's own center of gravity to the enemy's nuclear retaliation. The establishment of complete air superiority may be so expensive that future operations are jeopardized. While perhaps most difficult to achieve, the denial of resupply may be the most effective way to attack the center of gravity in the long run.

Thus, the significance of the concept of the center of gravity to the operational commander is to enable him to define clearly his own center of gravity, protect it, and attack his enemy's center of gravity with requisite determination. It is imperative that the operator return to the Clausewitzian axiom of "keeping the dominant characteristics of both belligerents in mind." It is not productive to win one operational campaign at the expense of the next -- thus losing the war.

In pursuit of the destruction of the enemy's 'operational center of gravity' it is necessary to explore several key questions: (1) What is the definition of the operational center of gravity? (2) Is there usually more than one operational center of gravity that can be attacked in a particular campaign? and (3) Is the concept of the center of gravity useful to the practitioner of the operational art?

Several historical examples of operational art will be examined with regard to the above questions. These examples are not used to support a particular point of view or to demonstrate a general truth, but rather to serve as an application and explanation of the concept of the operational center of gravity. Historical examples are more useful than imaginary ones, because, as Clausewitz explained, abstract discussion is easily misunderstood while historical examples have the advantage of being more

realistic and they bring concepts to life.¹² Therefore, operational examples from World War II will provide the basis for discussion of the outlined questions.

Before meaningful analysis can be conducted, the problem's parameters must be set. The operational level of war requires definition. FM 100-5, Operations (Draft) (Oct 85) defines the operational level of war as employing and co-ordinating actions of large forces, conducting campaigns or major operations in a sequential manner, and attempting to attain strategic goals in a theater of war.¹³ Based upon this definition of the operational level of war, let us examine several operational campaigns in World War II and attempt to apply the research questions in order to get a firm grasp on the operational center of gravity.

OPERATIONAL LEVEL WARFARE IN WORLD WAR II

Two examples of operational level warfare will be examined in relation to their centers of gravity. The examples are Rommel's 1942 campaign in North African and the Kursk Offensive in July of 1943. These particular campaigns were chosen because they serve as good illustrations of operational art. The purpose of these historical examples is to illustrate the concept of center of gravity at the operational level so that it can be more easily understood, rather than 'prove' any specific idea as universal.

The campaigns in North Africa from 1940 to 1943 are excellent illustrations of the operational level of war.

While a detailed account of the Desert Campaigns is not necessary, it is useful to touch on the important aspects of the action from both the Axis and Allied perspectives. Each side viewed the conflict differently and identified centers of gravity according to its own interpretation.

Based upon the definition of the operational level, both the British and the Germans were employing and co-ordinating actions of large forces in North Africa. The British Eighth Army conducted campaigns or major operations, such as BATTLEAXE and CRUSADER, in a sequential manner, attempting to attain two strategic goals, the defense of the Suez and the protection of Middle East oil. The Germans were also practicing the operational level of warfare. Their large force, Panzergruppe Afrika, conducted campaigns toward a strategic goal: prevention of Italian defeat in North Africa and their possible withdrawal from the war effort.¹⁴

A description of the events that make up the early North African campaigns begins with the Graziani's Italian advance on the British in Egypt in September of 1940. This campaign was followed by Wavell's offensive in December, 1940, which expelled the Italians from Egypt deep into Libya as far as Beda Fomm. This led to German intervention with the introduction of Rommel and the Deutsches Afrika Corps (D.A.K.) in March of 1941.¹⁵ Rommel's first offensive allowed D.A.K. to advance into Egypt as far as Salum by

April of 1941. Wavell's counteroffensive in June of 1941, Operation BATTLEAXE, was a failure but in November of 1941 Auchinleck's offensive, Operation CRUSADER, pushed Rommel back to El Agheila. Rommel's second offensive in January, 1942 forced the British back to El Alamein by June. This offensive will be examined for illustration of the center of gravity concept.

Rommel planned the campaign with the destruction of the British Eighth Army as the objective. According to Rommel, this would achieve the strategic goal of preventing Italian defeat by jeopardizing the Suez and the entire Middle East. He had Panzergruppe Afrika at his disposal, which consisted of the D.A.K. and the Italian forces in theater. The offensive began in January of 1942, (see map appendix A) and the surprised Eighth Army was forced out of Cyrenaica by the beginning of February. A stalemate occurred at the Gazala - Bir Hacheim Line until May when Rommel renewed the offensive (see map appendix B). Rommel attacked and fixed the enemy in the north with his Italian infantry and swept south of Bir Hacheim with his armor elements to outflank the Eighth Army. Losses required Rommel to withdraw into the 'Cauldron' to gather strength, to resupply, and to renew the attack. In early June, the Eighth Army conducted piecemeal attacks on the 'Cauldron.' These attacks were destroyed in detail, thus demolishing the British armor strength. Rommel continued his own attack in mid-June, took Tobruk and

advanced to Mersa Matruh. The British defended tenaciously but were forced back to El Alamein by July 1942. Both sides were exhausted and in need of reorganization.¹⁶ For this illustration the campaign ends here.

Both opponents' centers of gravity appear to have been the armored forces. All action on both sides revolved around the tank formations of the Germans and the British. However, this conclusion is an oversimplification at the operational level. By definition the operational level assumes automatically that large forces are opposing one another; to say the defeat of these forces is attacking the center of gravity is a simplification of the issue. The operational defeat mechanism lies in those key activities that cause the force to continue to fight. When one mentions key activities, they can be equated to sub-centers of gravity.

The Germans and the British both had specific dominant characteristics during this conflict. The strengths of the German forces were their greater combat experience, better tactical doctrine and execution, better leadership and superior equipment. The British strengths were the superiority of the defense, greater quantity of equipment, better supply system, and better support from their allies (commonwealth forces). German weaknesses included a weak ally in the form of the Italians and resupply difficulties.

The British weaknesses included a lack of dynamic leadership, inflexibility and inexperience.

These strengths and weaknesses formed the spokes of the wheel that connected to the hub of all power and movement, on which everything depended: the tank forces. To direct all energies against the hub without destroying some of the spokes was difficult at best as demonstrated by the failure of the British to destroy the German Afrika Corps by direct confrontation during Operation Aberdeen in June against the 'Cauldron.'¹⁷ On the other hand, the Germans were able to coordinate their efforts against some of the spokes in an effort to destroy the British hub. They applied their superior tactical strength against a corresponding British tactical and senior level leadership weakness and defeated the British in the 'Cauldron.'¹⁸

What was the operational center of gravity for each side during this campaign? Based upon the Clausewitzian definition, the center of gravity for the German forces was the German Afrika Corps, and for the British forces, it was the 1st and 7th Armored Divisions and the additional Armored Brigades. The destruction of these forces was the definition of victory and defeat during this campaign. Each side attempted to bring these forces to unfavorable battle while protecting their own armored formations. In this campaign, the Germans were more effective in concentrating their efforts against this center of gravity. Was there a

more cost effective manner of defeating these armored forces? If there was a more effective way to victory, does that mean there are other centers of gravity or simply different ways to destroy or neutralize the one center of gravity?

From the German point of view, several key elements led to their armored forces' success. The Afrika Corps' resupply situation was a decisive factor in all operations during the Desert Campaigns.¹⁹ The Luftwaffe's neutralization of British bases on Malta in March and April of 1942 permitted delivery of the requisite supplies for Rommel's continued offense.²⁰ Air support was another critical element in this campaign. Rommel's advance into Egypt could not be made without Luftwaffe support.²¹ While the armor was the hub of all action, the infantry was the outer rim of the wheel that allowed the armor its freedom of action. The flank protection provided by the Italian infantry of the XXI and X Corps at the battle at the Gazala - Bir Hacheim Line enabled German success in the 'Cauldron.' Had any one of these key elements been successfully destroyed, Rommel would not have enjoyed operational success.

In fact each one of these elements was attacked successfully in later campaigns and led to the operational defeat of the Germans. Allied control of the Mediterranean lines of communications eventually ended the Axis effort in

North Africa. Allied air superiority in the later stages of the North African campaigns eventually negated the Luftwaffe combined arms advantage enjoyed by the Africa Corps. The British defeated the Axis infantry at El Alamein which led to the withdrawal of Panzergruppe Africa in late 1942.

Does this infer that these key elements were also centers of gravity? These other key elements were sub elements of the one major center of gravity, the armor force. As such, they were sub-centers of gravity. There is a unity which allows for the identification of the single center of gravity, the armor force. That single hub of all power was dependent on the spokes of the wheel: the infantry, tactical skill, resupply, etc. In North Africa, the two centers of gravity confronted each other on the battlefield. In the early North African campaigns, the spokes of the wheel on the German side were stronger and initially, the British could not destroy these spokes nor did they concentrate on the spokes that they could destroy. The Germans attacked the vulnerable British spokes one at a time until the hub could no longer support the wheel. Without the unity of the entire wheel being preserved, the wheel collapsed for the British. Until their final defeat, the Germans, while they suffered considerable losses in some areas, always managed to patch any one spoke to preserve the unity of the wheel and, thus, the center of gravity. Only in the later North African campaigns did the Allies learn to

capitalize upon their relative strengths to defeat the spokes that supported the German center of gravity.

Another illustrative example is the German offensive at Kursk. Like North Africa, this campaign is an excellent example of operational art. The Germans were employing and co-ordinating actions of large forces, Army Group Center and Army Group South, conducting a major operation, Operation Citadel, in a sequential manner, attempting to attain a strategic goal: the seizure of the initiative on the Eastern Front for the spring and summer of 1943, in a theater of war, the Russian Front. The Russians also employed and co-ordinated the actions of large forces, The Central Front, the Voronezh Front and the Steppe Front, conducting a major operation, the defense of the Kursk salient, in a sequential manner, attempting to attain a strategic goal, the defeat of operational enemy forces to gain the initiative, in a theater of war, the Russian Front.

A brief account of the events leading up to the Battle of Kursk begins with the halt of the German Summer Offensive of 1942. The Russian Winter Offensive of 1942-1943 saw the capitulation of Stalingrad and withdrawal of German forces to the Donets River. The Russian attempt to destroy Army Group South was thwarted by Manstein, and the situation was temporarily restored by the German Kharkov Counteroffensive in the spring of 1943. One of the results of this counteroffensive was a large bulge in the German lines in

the vicinity of Kursk. The Germans felt success at Kursk could remove a possible threat to the flanks of two German army groups, destroy large Soviet forces in the salient, and draw enemy armor into the salient where it could be defeated.²² Further discussion will address the operations from May until the 13th of July when Hitler discontinued the attack.

The Germans planned a concentric attack with the Ninth Army of Army Group Center attacking south from Orel and the Fourth Panzer Army of Army Group South attacking north from the Belgorad - Kharkov area to join east of Kursk.²³ (see appendix C) The Ninth Army in the north made penetrations of only nine miles before Russian pressure in the Orel bulge caused the attack to be called off on 11 July. In the south, Army Group South made slow progress but was successful enough to force the commitment of Soviet tank reserves to stop the Germans. The Soviets had obtained excellent intelligence prior to the operation and planned a thorough defense.²⁴ For the first time, the Germans faced an extensive defense in depth backed by large armor reserves. For example, the Germans were facing the defensive positions of three successive divisions, each with two echelons in depth before operational penetration could be achieved in the Kursk salient.²⁵ Thus, the Germans were required to penetrate six tactical defensive belts before they could achieve success. The Germans hammered themselves

against these defenses until they were defeated. On the 13th of July, Hitler cancelled Operation Citadel, ostensibly because of the invasion of Sicily.²⁶

Again, the center of gravity for both opponents appears to have been the mobile armored forces of each. To be successful, the Germans had to break into the operational depth of the Soviet defenses with their tank forces. Once behind the prepared defenses, the Germans hoped to repeat earlier blitzkrieg success. The Soviet center of gravity also appears to have been those tank forces that had the ability to stop the Germans when a penetration was made. Had these forces been used improperly as they had been earlier in the war, the Soviets would not have been able to stop the Germans.

These Soviet tank forces were supported by other key elements that gave freedom of action to the hub. The Germans' strength lay in their technological edge in equipment, greater experience and superior military proficiency. The Soviet's strength lay in tactical combined arms defense, their quantity of men and equipment, excellent intelligence, thorough planning, and operational maturity. The major German weakness was their inability to replace their armor losses. The Soviet weakness was an inability to match German armored combined arms forces in a maneuver battle.

These strengths and weaknesses formed the spokes of the wheel that connected the hub of all power and movement, on which everything depended: the tank forces. The Germans had to penetrate the Soviet tactical defenses to force the commitment of the Soviet armor forces. The Soviet tactical defense was so strong that it prevented the Germans from reaching operational depth where its strength could most effectively be used. The Soviets' tactical defense was formidable because of their excellent intelligence. They were able to concentrate men and equipment in the Kursk salient because they had confidence in the detailed foreknowledge of the German plan. Without this intelligence, could the Soviets have taken the risk of concentrating so many assets in the salient? Without the strength of these two spokes in the Soviet wheel, the hub would have become vulnerable to the German center of gravity.

According to von Mellenthin, in his book Panzer Battles, the German army threw away all its advantages in mobile tactics by choosing to fight the Russians at Kursk.²⁷ If the center of gravity (armored forces) at Kursk was the same center of gravity (armored forces) at Kharkov in the spring of 1943, where the Germans were successful, why were the Germans unsuccessful at Kursk? The reasons were that the key elements that led to the earlier success of the German armored force were negated by the Soviets at Kursk.

When the Germans were able to bring the Soviets to battle in the open steppe, the spoke of German superior military proficiency could be brought to bear against corresponding Russian weaknesses. This sub-center of gravity could not be used to its maximum effect unless it had maneuver room to operate. The tactical defenses at Kursk attacked this particular spoke or sub-center of gravity and negated the strength that the Germans normally enjoyed against the Russians.

The two centers of gravity -- the armored forces -- met on the battlefield at Kursk. The result was a battle of attrition which the Germans could not afford, while the Soviets were in a much better position to absorb the losses inflicted. With the defeat of the German operational effort at Kursk, the strategic initiative passed to the Russians and was never regained again by the Germans.²⁸

These two examples of operational centers of gravity are not meant to demonstrate any singular truth about the concept. They are merely illustrative examples of the complexity of the elements that make up the concept. In both of these examples there was one unifying center in the form of the armor forces of each. The armor force was the center of all power and movement, on which everything depended. These examples do not support the contention that all energies should be concentrated directly against the center of gravity itself. The other sub-centers of gravity

or spokes of the wheel that supported THE center of gravity, the hub of the wheel, appear to have been the more effective target for the operational player.

DISCUSSION OF THE OPERATIONAL CENTER OF GRAVITY

We return briefly to the Clausewitzian definition of the center of gravity:

"What the theorist has to say here is this: one must keep the dominant characteristics of both belligerents in mind. Out of these characteristics a certain center of gravity develops, the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed.²⁹

He further states that in a theater of war, no matter what size the forces stationed there, there is a unity in which a single center of gravity can be identified.³⁰

This definition will suffice for THE center of gravity at the strategic, operational and tactical levels of war. However, this definition is not complete enough. It suggests an attritional style of warfare with two opposing centers of gravity in a death struggle on the open battlefield, influenced only by their intrinsic power. The examples in North Africa and on the Eastern Front illustrate that the power of one center of gravity derives its true strength from numerous other smaller, but critical, sub-centers of gravity. Thus, to say that THE center of gravity is the point against which all our energies should be directed, does not take into consideration the dominant

characteristics of the opposing forces and leads to an attritional outcome. This tends to support the Clausewitzian axiom that the largest army at the decisive point is the best insurance of victory.³¹ In World War II, at the operational level, the strengths and weaknesses of the lesser sub-centers of gravity that supported THE center of gravity often became the key to success and failure.

Does Clausewitz base his concept of a single center of gravity on the general assumption that field army capabilities in an operational environment are usually equal?³² If this assumption is correct, then Clausewitz is correct when he favors the side that has the biggest battalions. However, the complexity of the modern operational battlefield assumes field armies of vastly different capabilities. This was demonstrated in World War II and is probably true more emphatically today. The operational force on the modern battlefield is a product of force structure, equipment, and training decisions that were made years prior to the engagement. The economics of these decisions dictate that while strengths can be developed in some areas, there will be inherent weaknesses in others. This complexity at the operational level could not be foreseen by Clausewitz. Thus, modern applications of his concept of the center of gravity have become increasingly complex as have the means and options for conducting battle.

This leads us to the question: Is there usually more than one operational center of gravity in a particular campaign? The definition of the operational level assumes co-ordinated action, by large forces. Does that mean that by definition, at the operational level, these large forces are the center of gravity? In the two examples mentioned in this paper, only a small portion of the overall force was THE center of gravity - the armored forces. There were several important sub-centers of gravity that supported and sustained the overall center of gravity which provided unity to the rest. Today THE center of gravity rarely has the opportunity of direct confrontation with the opponent's center of gravity - thus producing the Clausewitzian battle of annihilation.

Colonel John Boyd, USAF, outlines the concept of multiple centers of gravity in his unpublished briefing, "Patterns of Conflict." In this briefing, Colonel Boyd criticizes Clausewitz for failing to develop the idea of generating non-cooperative centers of gravity by striking at those vulnerable, yet critical, activities that permit a larger center of gravity to exist.³³ Colonel Boyd goes on to state that non-cooperative centers of gravity can be generated as well as attacking those centers of gravity upon which the opponent depends, so that friction is increased; cohesion is shattered, and paralysis is produced, bringing about the eventual defeat of the enemy.³⁴ It was apparent

in the examples of World War II operational art that many sub-centers of gravity existed within a particular campaign. These lesser sub-centers of gravity formed the spokes and rim of the wheel for which the unifying center of gravity formed the hub. The destruction of critical spokes caused the hub to become unbalanced and eventually tore the wheel apart. Much like the concept of the center of gravity in physics, a portion of the airplane in flight may be destroyed without substantially changing the center of gravity within the airframe, but if the destroyed portion is the tip of the wing, this unbalances the whole system and causes the airplane to tear itself apart in the air. This complex physical phenomenon is similar to the situation on the operational battlefield. The operational practitioner wants to destroy the center of gravity without having to attack it directly.

The concept of the center of gravity becomes useful to the operational planner when he clearly understands all of the sub-centers of gravity that support the one unifying center of gravity. The identification of the hub upon which everything depends may be a relatively easy task. The method to attack and destroy that hub certainly is not. The operational planner must keep the dominant characteristics of both belligerents in mind when he is formulating his operational plan. In addition to identifying the sub-centers of gravity of the enemy, he must clearly

recognize his own sub-centers of gravity and protect them accordingly. Though this concept dates at least to Sun Tzu, "Know the enemy and know yourself; in a hundred battles you will never be in peril," the losing side in every campaign violates this axiom.³⁵ Therefore, the practitioner of the operational art must understand his strengths and weaknesses in relation to his enemy's strengths and weaknesses. Only then can he single out those spokes of the wheel, those lesser sub-centers of gravity, that can be successfully attacked while protecting his own spokes. The operational planner's object is to destroy the enemy's center of gravity with the least amount of effort. If the destruction of a poorly guarded spoke causes the wheel to disintegrate by its own continued movement, the campaign's success will be all the more brilliant because of the economy with which it was achieved.

CONCLUSIONS

The concept of the operational center of gravity requires more than one sentence to define adequately. The operational center of gravity is the hub of the wheel from which the force attains its freedom of action to exert its will upon the enemy. This hub is supported by lesser sub-centers of gravity that form the spokes of the wheel, that allow the center of gravity to exert its power. These spokes are relative in nature and consist of the strengths and weaknesses of the force. All energies should be devoted

to upsetting the balance of the enemy's centers of gravity while protecting the balance of one's own centers. This definition allows for the indirect approach which has resulted in success on the modern battlefield.

At the operational level, there is usually one unifying center of gravity which is 'the hub of all power and movement, on which everything depends.' This center of gravity is supported by lesser centers of gravity that are relative in nature and are the composite strengths and weaknesses of the force. These lesser centers of gravity form the framework and boundary which give the unifying center of gravity its strength.

The concept of the center of gravity is useful at the operational level. If the centers of gravity can be identified and clearly analyzed, a coherent, long range operational plan can be formulated and executed. One key aspect of this concept is that one recognizes one's own centers of gravity so that they can be adequately protected. Often a force attempts to use its strengths against enemy strengths because that is what is most easily understood. The highest payoff may be in an area of adequate strength against a known enemy weakness. Commanders must be constantly aware of the ever changing nature of relative strength and weakness. The enemy may often be better understood than the capabilities of one's own forces.

The significance of this concept at the operational level is that the centers of gravity of the modern force are being formed today. On the next battlefield the forces will be employed as presently structured and trained for a possibly short and violent conflict. The organization, equipment and training of that force is being accomplished today. The sub-centers of gravity in relation to our possible foes must be clearly identified now. No one sub-center of gravity, or spoke in the wheel, must be allowed to go unprotected while we seek to impose our will upon the enemy's sub-centers of gravity. A relative strength in two sub-centers of gravity may not compensate for a significant weakness in another area. A strong Air Force and Navy in theater may not make up for the lack of a short range air defense weapon system.

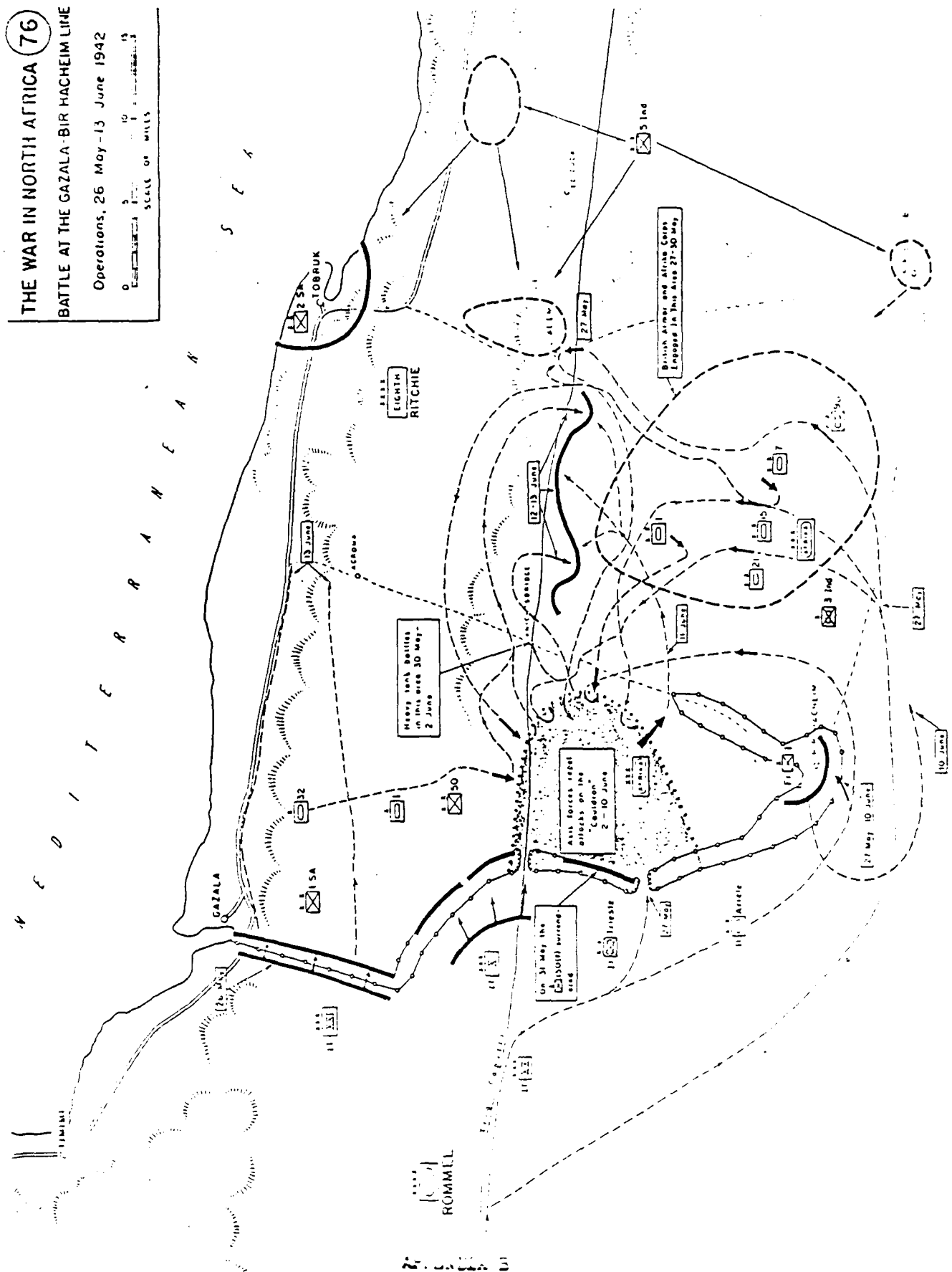
Clearly, our training system must educate our leaders on the sub-centers of gravity of our potential foes and our own forces. The system must first educate on how to recognize these sub-centers and second on how to capitalize on their discovery. Techniques must be inculcated in the force which maximize our relative strengths while minimizing our weaknesses. If this mission is accomplished, 'we will know our enemy as we know ourselves and in a hundred battles we will never be in peril.'

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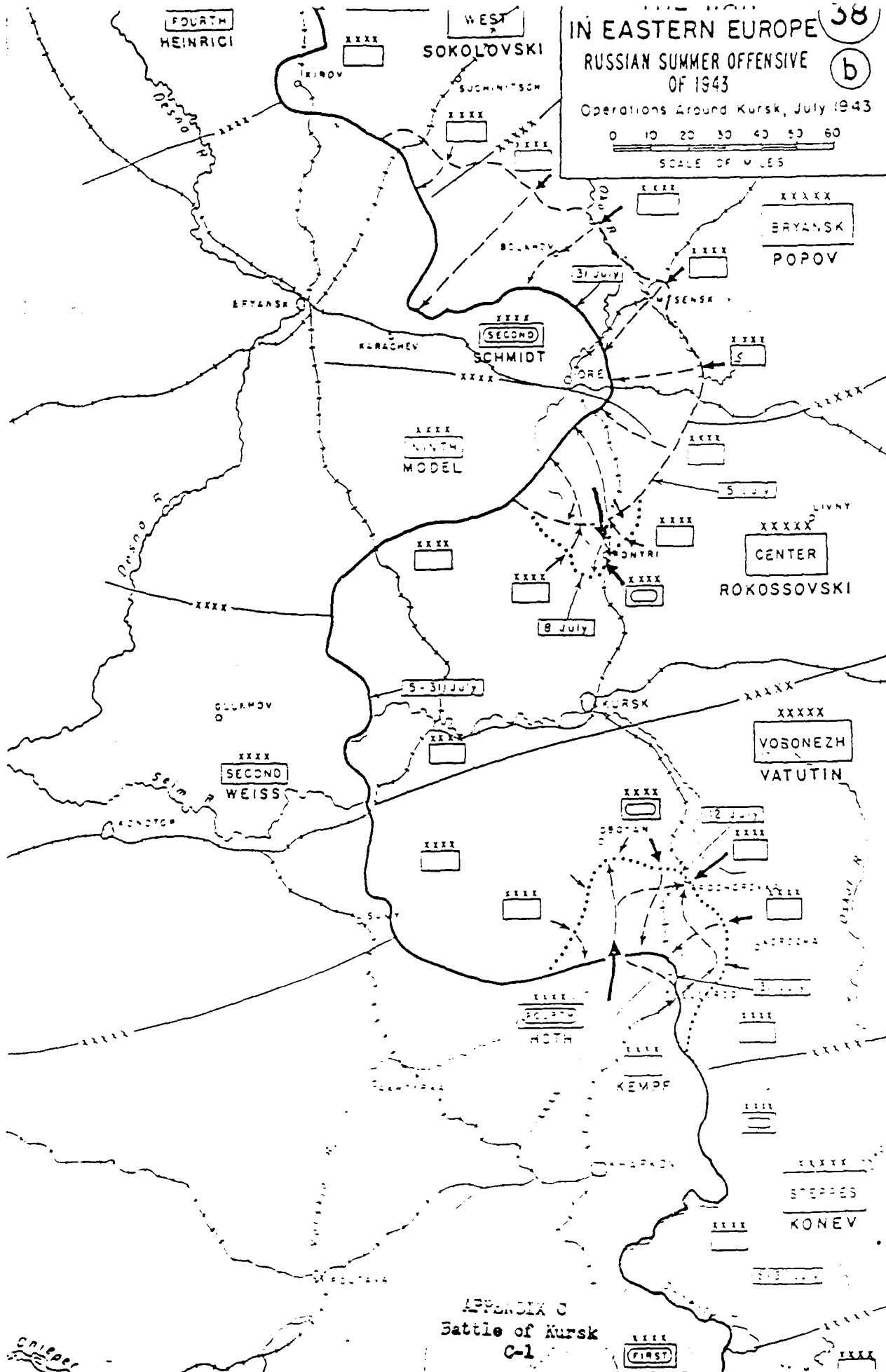
BATTLE AT THE GAZALA-BIR HACHEM LINE

Operations, 26 May-13 June 1942

0 5 10 15
SCALE OF MILES



Detail of Gazala - Bir Hacheim Line
B-1



APPENDIX C
Battle of Kursk
C-1

ENDNOTES

¹Webster's New World Dictionary of the American Language, College Edition (New York: The World Publishing Company, 1960), p. 237.

²Jeppesen Sanderson, Private Pilot Manual (Denver, Colorado: Jeppesen Sanderson, Inc., 1976), p. 1-22.

³Carl von Clausewitz, On War ed. and trans. Michael Howard and Peter Paret (Princeton, New Jersey: Princeton University Press, 1974), p. 595.

⁴Ibid., p. 258.

⁵Ibid., p. 485.

⁶Ibid., p. 486.

⁷Ibid., p. 487.

⁸Ibid., p. 593.

⁹Ibid., p. 178.

¹⁰Ibid., p. 486.

¹¹U.S. Army, FM 100-5, Operations (Washington, D.C.: U.S. Army, 28 Oct 1985), p. C-1.

¹²Clausewitz, p. 171.

¹³Operations, p. 2-2.

¹⁴Generalmajor Burkhardt Meuller-Hillebrand, "Germany and Her Allies in World War II". Donald S. Detwiler, gen ed. World War II German Military Studies, 24 vols. (New York: Garland Publishing, 1979), Vol. 20: Part VIII Diplomacy, Strategy, and Military Theory, MS# P-108, Part I, p. 11.

¹⁵BG Vincent J. Esposito, ed., The West Point Atlas of American Wars, Volume II 1900-1953 (New York: Frederick H. Praeger, Publishers, 1967), p. Map 74, WWII.

¹⁶Ibid., pp. Map 74-75, WWII.

¹⁷Barnie Pitt, The Crucible of War: Year of Alamein 1942 (London: Jonathan Cape, 1980), pp. 63-64.

18MG F. W. von Mellenthin, Panzer Battles (Oklahoma: University of Oklahoma Press, 1956), pp. 132-133.

19Ibid., p. 67.

20Ibid., p. 107.

21Ibid., p. 150.

22Field Marshal Erich von Manstein, Lost Victories ed. and trans. Anthony G. Powell (Novato, California: Presidio Press, 1982), pp. 446-447.

23Geoffery Jukes, Kursk, The Clash of Armour (New York: Ballantine Books, 1970), p. 83.

24Ibid., p. 47.

25COL David M. Glantz, Soviet Defensive Tactics at Kursk, July 1943 (Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, February 1985), p. 38.

26Manstein, p. 448.

27Mellenthin, p. 264.

28Ibid., p. 278.

29Clausewitz, pp. 595-596.

30Ibid., p. 487.

31Ibid., p. 197.

32Ibid., p. 282.

33COL John Boyd, USAF "Patterns of Conflict" Army - Air Force briefing on the theory behind AirLand Battle (Fort Leavenworth, Kansas: March 1984), p. 41.

34Ibid., p. 115.

35Sun Tzu, The Art of War (New York: Oxford University Press, 1971), p. 84.

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